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ABSTRACT

Most computer training has made little distinction between the training of teachers and computer professionals, and few of the professional training courses discuss the fundamental elements of curriculum revision in connection with computing literacy and implementation. The implementation of computing via the microcomputer at the United Nations International (Elementary) School was studied as a change process over a 5-year period. Several aspects of the change literature thought to be advantageous in implementing change were used in the program design, implementation and evaluation. Attendance was voluntary; the instructor was a fellow teacher; instruction was conducted over an entire academic year; and formative evaluation was used to secure continuous feedback. Evaluation data provided insights into participant reactions and attitudes. The goals of this program, which were to demonstrate an increase in faculty awareness of possible computer classroom interactions and to extend this usage to demonstrated exploratory and experimental usage were successfully accomplished. A major long-term goal of inducing changes in the elementary curriculum and classroom routine has been partially accomplished, and future plans include the introduction of LOGO into the upper elementary curriculum. Both teachers and students perceived learning via the system to be as effective as in traditional instruction. This report lists 15 references. (Author/LMM)

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Technology Implementation: A Case Study

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By

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ABSTRACT

As computers become increasingly available in classrooms, a need emerges for training courses specifically designed for teachers. Education-specific instruction has been a major omission of most computer training as little distinction has been made between the training of teachers and computer professionals. Training teachers in computer literacy for classroom implementation encompasses a wide range of competencies which have only recently been addressed. And few of the professional training courses discuss the fundamental elements of curriculum revision in connection with computing literacy and implementation. This paper presents a case study of the computing integration efforts of one elementary school. After an informal needs assessment, it was decided a specific training program was needed to involve the faculty in computing beyond the interest level. Several aspects of the change literature thought to be advantageous in implementing change were used in the design, implementation and evaluation of the program. Attendance was voluntry; the instructor was a fellow teacher; instruction was conducted over an entire academic year, and formative evaluation was used to secure continuous feedback. Data collected in during the evaluation process provided insights into participant reactions and attitudes toward computing and the training program.The goals of the program: to demonstrate an increase in faculty awareness ofpossible computer classroom interactions and to extend this awareness to demunstrated exploratory and experimental classroom usage by .the participants were successfully accomplished during the first year of the program. A major long-term goal, to enhance the implementation of classroom computing in a manner to induce changes in both the elementary curricula and classroom regularities has been partically accomplished, as future plans include the introduction of LOGO into the upper elementary curriculum. A definite commitment toward permanent implementation by both the administration and faculty has become a reality.

As computers become increasingly available in classrooms, a need emerges for training courses specifically designed for teachers. The history of computer training in education which began in the late sixties, concentrated primarily on student competencies. Skill development in training students in computer literacy and/or programming skill was the focus: the specific needs of teachers received scant attention.

Education-specific instruction has been a major omission of most computer training. Little distinction has been made between the training of teachers and computer professionals. Sitting side-by-side in classrooms, they experienced the same professionalized instruction.There is now, however, increasing support for specific teacher training in educational computing, as the concern develops that teachers require an alternate instructional approach (Holloway & Winner, 1983; Rawitsch, 1981).

Training teachers in computer literacy for classroom implementation encompasses a wide range of competencies which have only recently been addressed (Poirot, J.,Taylor, R. & Powell, J., 1981). To fulfill its potential of improving instruction and learning, computing requires integration into the curriculum which will involve both specific and generic changes. As it is important to match technologies with learning paradigms of children, it will be necessary to shift the focus of learning from product to process, especially at the elementary level.

The present dominance of computer-assisted drill and practice software creates a need for instruction in other computing modes. Instead of merely adding computing exercises to an already overcrowded group of learning activities, it is appropriate now to rethink approachs to learning. New models need to be developed for the best use of the microcomputer in the classroom. Curriculum change with its pressures for new habits, new procedures and new learnings requires the support of informed instruction.

The need for precise computing training became increasingly evident as one school, the United Nations International School, began its exploration of computing via the micrcomputer. This paper presents a case study of the computing integration efforts of its elementary school during the past six years. A background of its computing development, the methods used to facilitate permanent implementation and a glimpse of future plans will be presented.

Preliminary Focus

Although educational computing has existed for about thirty years, elementary schools were largely excluded from the early thrust until the explosion of the microcomputer in the late 70's. The United Nations International School, a K through 12 facility which services the missions and staff of the United Nations was no

exception. Until the purchase of the first microcomputer, a Radio Shack TRS-80 Model I, in October 1978, there was no regular computing effort in its elementary school. An after-school program was begun the previous year, but enrollment and access was limited. Only a handful of fifth graders received training on an antiquated PDP/8 housed in the secondary school, and although enthusiasm ran high, a one hour weekly lesson at the end of a long school day for eight to ten upper elementary children did not constitute a computing program. Increasing computer awareness of the general elementary population only began when microcomputers entered the elementary classroom.

Gradually more computers were purchased, primarily with funds from the after-school program's budget. Presently the Junior House is equipped with seven Radio Shack computers, two with disk drives, one networking system and a printer. There are also three Apple-Two Plus computers, belonging to faculty members, which are available for use.

The early computing experiences were exploratory. There were no precedents to follow as very little was known about computers and young children in classroom situations. The work of Suppes (1968;1972) and Papert (1980a; 1980b) was highly specialized and did not easily apply to classroom environments. Suppes work, important as it was in analyzing the structure of mathematics learning in young children, was confined exclusively to CAI, largely involving a hookup to the large computer at Stanford

University. Papert's seminal work with LOGO, while informative and original, used a laboratory approach to learning. Its transfer to the classroom is still in the experimental stages, due in part to the very recent commercial availability of LOGO. In a sense, elementary educators were left to their own devices to explore the microcomputer in classroom situations.

The motivation of the children provided a positive beginning, and it has continued to the present. Children are fascinated by the interactive mode of computing. The possiblities of control over the machine has a slightly hynotic effect on them. This fascination seems to grow with increased familiarity, and one notices the somewhat addictive nature of computing, which has not diminished after five years of exposure.

Using the change literature as a guide to understanding, UNIS' developing computing implementation can be discussed as a process of change. There is agreement in the literature that change occurs in stages (Havelock, 1973; Paul, 1977; Rogers & Shoemaker, 1971). Both Paul and Rogers and Shoemaker list four steps in this process: 1) initial knowledge of the innovation, 2) persuasion leading to the formation of attitudes about the innovation, 3) decision to adopt or reject the innovation, and 4) confirmation from peers of that decision. These stages are compared to the learning process as activities in kind "... the way in which new ideas are adopted by an individual

is essentially parallel to how any type of learning takes place" (Rogers & Shoemaker, 1971, p. 103).

Havelock (1973) develops six stages: awareness, interest, evaluation, trial, adoption and integration, which compare to Rogers and Shoemaker's intervals of the adoption process (i.e. stage three of the change process), and will be used in this discussion on the progress of one elementary school toward computing integration.

Computing awareness and interest were initially developed in many ways: demonstrations for the faculty, student-conducted classroom introductions and initial classroom instruction (Winner, 1980). Formal and informal computer demonstrations were held at faculty meetings. Examples of computer-assisted instructional programs and computer graphics for simulations and art instruction were previewed. In addition, a few fifth-grade children working with computing as an enrichment activity in were enlisted to demonstrate the computer to their peers and the younger children. They moved the microcomputers into the various classrooms, explained loading procedures, introduced programs, and assisted interested teachers.

Developing instructional materials was more difficult. In the beginning, games were used to introduce computer literacy and to strengthen basic skill development (Winner & McClung, 1981). Later a few units were written for the mathematics curriculum, as most of the existing software was math related. The fact that the

software was CAI drill and practice did not lessen the early enthusiasm, but it was the reason for a greater emphasis on gaming, than probably would have been the case, had other materials been available.

Some attempt was made to introduce BASIC progamming into the curriculum, but at that time it could only be an enrichment activity for more gifted students. Time and equipment was lacking for a more thorough experimentation. Even today programming remains largely an after-school activity.

At the outset, faculty involvement was sproadic. Two or three teachers showed initial interest but progress toward a commitment to implement computers in the classroom was not forthcoming. Cassette loading was unreliable, educationally sound programs were scarce, and programming instruction for non-professionals almost non-existant. While pupil enthusiasm continued to grow, faculty involvement did not develop beyond the interest stage. A more specific approach appeared to be necessary.

Inservice Training

After an informal needs assessment, it was ascertained that a specific training program was needed to involve the faculty in computing beyond the interest level. If computing in the elementary school was to become more

than a fad or a pioneer experiment, the staff needed extensive computing training. Consequently an inservice program was created as an alternative to the workshops run by computing professionals who have little knowledge of classroom environments. The program began as a year-long bi-weekly series of after-school workshop sessions, open to all elementary teachers.

The objectives of the program can be best described in short and long term goals. The short term goals were to demonstrate an increase in faculty awareness of computer uses in classrooms and to extend this awareness to demonstrated exploratory and experimental classroom usage by the participants. The long-term goal was to enhance th implementation of classroom computing in a manner to induce changes in both the elementary curricula and the regularities in classroom procedures.

Several aspects of the change literature (Rogers & Shoemaker, 1971) thought to be advantageous for implementing lasting change were used in the program design, implementation and evaluation. Attendance at the training sessions was voluntary. There was no administrative pressure to force attendance or computer usage. The response was positive, between one-third and one-half of the staff regularly attended the sessions, and the atmosphere has been congenial and relaxed.

Secondly, the instructor/program designer was a fellow teacher, familiar with the regularities of the school, and

consequently, could structure the program to incorporate the ideosyncratic needs of the staff. As a colleague, she could also provide continuing assistance on an individual basis in the intervals between training sessions.

A third ingredient was the length of the training period. The spacing of the sessions was consistent with the importance of time to the learning of new tasks and strategies. It was thought that scheduling the workshop sessions at twice-monthly intervals would allow the participants ample time for exploration and experimentation of the material presented at each session.

A final program design component of interest to this discussion was the use of a formative evaluation process to secure continuous feedback. Several evaluatory methods were used at each session and their analysis helped to shape the direction of the program. The course content was adjusted to reflect the specific requests, needs and desires of the staff, and the on-going evaluations allowed them to participate in the design as well as the learning phases of the program.

The content also reflected the needs of elementary teachers as generalists. It attempted to provide an undertanding of computing as an entity and an awareness of the necessity for curriculum development to incorporate process learning problem solving strategies.

The underlying theme was "wise-use" of the computer in the classroom. The focal point being Taylor's (1981)

model of classroom computer usage. Together with a careful analysis of CAI, examples of tool-mode computing (c.f. Winner, 1982) and programming instruction in BASIC and LOGO were presented.

The training program has fulfilled its short term objectives and there is a beginning achievement of the long term goal. Computers have been used in all elementary classrooms, grades one through five, and regular classroom training has commenced in the intermediate grades. Instruction in computer awareness, computer literacy and computer implementation are being conducted in grades three, four and five respectively. And all intermediate pupils receive hands-on instruction on a weekly or bi-weekly basis.

Stages of Development

The faculty involvement in the computer implementation process paralleled the adoption process as described in the literature (Rogers & Shoemaker, 1971; Havelock, 1973). Data from three separate sources was collected during the first year of the training program: participant evaluations, outside evaluators chosen from their professional experience in the fields of curriculum development and computing, and a log kept by the instructor. As one reviews these data distinct stages of development are evident (Winner, 1982).

The first stage of awareness furnishes a certain

familarity with computer usage. It is in this period that the exposure to the magnitude of the computing potential is disconcerting. The uncomfortability with their lack of knowledge, of which Rawitsch (1981) warns us, caused adjustment difficulities in some of the participatants. A few did not return after their initial exposure.

If interest can be sustained through this difficult awareness period, teachers move rapidly to the exploratory and experimental stages. A few moved too quickly. Some combined these activities, while others omitted individual exploration and began immediately with experimentation with their classes.

The data indicated that experimentation without prior or parallel exploration was not the most prudent method of computer utilization, as it did not produce confident computing teachers. Those who did not throughly familiarize themselves with the program content and/or the operating procedures before use in the classroom were unable to proceed without substantial assistance. All participating teachers required initial asistance but many learned to be self-sufficient. The third grade teachers, for example, were able to operate an impressive computer awareness program with their classes without aid from either the workshop instructor or older students.

After substantial experimental experiences, the faculty expressed interest in increased computer access. Requests were made to have a computer available in or near

the classroom on a more permanent basis. A willingness for greater flexibility in the use of the computer in the classroom was apparent at this developmental level. The movement away from totally teacher-directed computer activities toward a shared responsibility became a desired, but usually unstated, objective, as the pupils acquired an understanding of the operating procedures and were able to select and load programs without assistance.

It is in this semi-permanent computer usage stage where curriculum development can commence. This could be compared to Rogers and Shoemaker's trial stage. Teachers begin to experiment with different aspects of the curriculum and adapt computer implementation to their personal teaching styles.

Children's reactions to computing assist in shaping teaching styles.Their interaction with the computer over a period of time, the kinds of programs they choose to use, and the reshaping of the group dynamics all effect faculty attitudes toward computing implementation.

Teachers' computing styles are reflective of their general teaching styles and as varied. There is no one best method of computer use, and teachers require substantial experimentation in own their classrooms to develop familarity and mastery. With the development of a personal style, the computer integration into the existing curriculum is established.

The final stage of development, curriculum revision

for permanent implementation, would appear next.This differs somewhat from what Rogers and Shoemaker refer to as "adoption", it is rather what instructional technologists call "adaption", the use of a technology rather than its initial purchase (Holloway, 1982). Adoption of computers into education without parallel adaption (i.e. curriculum development) might lead to untimely obsolesence (Winner & Holloway, n.d.). As yet curriculum development implementing the computer into a new paradigms of learning is not a reality, but there are indications that the potential increases if the preceeding stages are completed.

Personal and cultural traits effect the initial attitudes toward computer use, but after the beginning trepidations are overcome, individual self-confidence, ample exploratory experiences, coupled with a conviction in the importance of computers in elementary education seem to be the most promising indicators of increased computer implementation.

Implementation and Beyond

After five years of computing, UNIS has undertaken a commitment toward permanent implementation. A joint decision by the elementary faculty and administration has been made to incorporate programming into the upper elementary curriculum. LOGO will be taught as an integrated component of that curriculum, and instruction

will begin next year. Due to hardware restraints, programming will begin at one grade level only, but within the next three years, integration at all intermediate levels is planned. Pilot studies will also be conducted in the primary grades to test the feasibility of programming instruction with young children. Contemporary research suggests that programming with LOGO is an ideal first programming language and may be an excellent method of introducing problem solving strategies to primary youngsters (Papert, 1980 (a), (b); Papert, Watt, diSessa & Wier ; 1980).

The administration has embarked on a fund-raising campaign to purchase the necessary equipment. A ratio to one computer to two children is contemplated. The computers will be housed in one classroom, and all instruction will take place there. Additional hardware purchases are planned to equip each grade level with a minimum of twelve computers.

The merits of separate computer laboratories as opposed to computers in each classroom cannot be resolved with the present paucity of equipment. Easy access to equipment seems to be an essential facet of successful computing, but financial constraints will limit this in the near future. Equipping one classroom with enough hardware for the entire grade and rotating its use is a viable alternative. Careful scheduling to ensure flexibility appears to be

essential.

A commitment of computing implementation, however, is only a beginning toward full integration. The key to success hinges on a strong commitment of the faculty toward further growth and knowledge. A major difficulty toward computing integration at the elementary level is the lack of training facilities for teachers. An introductory course, or two-week summer workshop, or even specific long-term programs such as the one described here, are not enough. Teachers embarking on computing instruction need continuing support and training which is responsive to their individual needs.

Just as children's responses to computing are varied and individual, so are teachers. Some learn rapidly and are motivated by their success toward continued growth, others progress more slowly toward ease and compatibility with the complexities of computing. Intelligent assistance in the early years of mastery appears to be a crucial element of continued success.

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